

Claims

1. Solid phase extraction process comprising one or more of the following steps:

a) conditioning a sorbent in a cartridge, a liquid suitable for conditioning being

5 passed through the cartridge;

b) applying a sample that contains the analyte to the sorbent, a liquid which contains the sample being passed through the cartridge;

c) washing the sorbent, a wash liquid being passed through the cartridge;

10 d) eluting the analyte from the sorbent, an elution liquid being passed through the cartridge,

characterised in that the temperature of the cartridge is controlled during one or more of the steps a) to d).

2. Solid phase extraction process according to Claim 1, characterised in that the temperature of the cartridge is controlled by heating or cooling one or more of the liquids used in step a) to d) before feeding to the cartridge.

15 3. Solid phase extraction process according to Claim 1 or 2, characterised in that the temperature of the liquid for conditioning of the sorbent is controlled.

4. Solid phase extraction process according to Claim 1 or 2, characterised in that the temperature of the liquid which contains the sample is controlled.

20 5. Solid phase extraction process according to Claim 1 or 2, characterised in that the temperature of the wash liquid is controlled.

6. Solid phase extraction process according to Claim 1 or 2, characterised in that the temperature of the elution liquid is controlled.

25 7. Solid phase extraction process according to one of the preceding claims which also comprises the step of drying the cartridge, before or after one or more of the steps a) to d), drying being carried out by passing a suitable gas through the cartridge, characterised in that the gas is heated prior to feeding to the cartridge.

8. Solid phase extraction instrument, preferably according to one of the preceding claims, comprising:

30 - at least one line system for transporting a liquid;
- a cartridge exchanging system having at least one cartridge holder incorporated in the line system;
- a sample feed device connected to the line system;

REPLACED BY
ART 34 ART

- a solvent feed device connected to the line system,
characterised in that

the line system is provided with heating and/or cooling means upstream of the at least one cartridge holder.

5 9. Solid phase extraction instrument according to Claim 8, comprising a control system, characterised in that the control system is equipped to be able to control the heating and/or cooling means.

10 10. Solid phase extraction instrument according to Claim 8 or 9, characterised in that the line system is provided with a gas connection and valve means in order to connect the gas connection to the heating and/or cooling means and the at least one cartridge holder in such a way that gas issuing from the gas connection flows successively through the heating and/or cooling means and the at least one cartridge holder.

11. Solid phase extraction instrument, comprising:

- at least one line system for transporting a liquid;
- 15 a cartridge exchanging system having at least one cartridge holder incorporated in the line system;
- a sample feed device connected to the line system;
- a solvent feed device connected to the line system; and
- a control system,

20 characterised in that

the cartridge exchanging system comprises:

- at least one cartridge magazine having a multiplicity of cartridge locations or at least one cartridge magazine holder in which at least one cartridge magazine having a multiplicity of cartridge locations can be accommodated; and
- 25 a transport system for moving cartridges; and

in that the control system is equipped to:

- determine one of the multiplicity of cartridge locations depending on a command given to the control system via input means; and
- control the transport system to place a cartridge in said specific cartridge location or

30 to remove a cartridge from said specific cartridge location.

12. Solid phase extraction instrument according to Claim 11, characterised in that the cartridge exchanging system comprises two of said cartridge holders incorporated in the line system and in that the transport system comprises optionally two cartridge grippers for

REPLACED BY
AFT 2004/07/07

picking up, moving and setting down cartridges, which cartridge grippers can be controlled essentially independently of one another by the control system.

13. Solid phase extraction instrument according to Claim 11 or Claim 12, characterised in that the control system is equipped to control the transport system to move 5 a cartridge between a cartridge location and a cartridge holder, or vice versa, and/or between two cartridge holders.

14. Solid phase extraction instrument according to one of Claims 11 - 13, characterised in that the transport system comprises a guide bridge with one or more cartridge grippers mounted thereon and movable along said guide, in that the guide bridge 10 is mounted above the at least one cartridge magazine, or the at least one cartridge magazine holder, and in that the guide bridge and the at least one cartridge magazine, or the at least one cartridge magazine holder, are movable relative to one another in a direction essentially transverse to the longitudinal direction of the guide bridge, and in that the control system is equipped to control this mutual movement.

15. Solid phase extraction instrument according to Claim 14, characterised in that the control system is equipped to move the at least one cartridge magazine, or the at least one cartridge magazine holder.

16. Solid phase extraction instrument according to Claim 11 or 15, characterised in that this comprises at least two cartridge magazines, or cartridge magazine holders, which 20 are positioned alongside one another viewed in the longitudinal direction of the guide bridge and in that said cartridge magazines, or cartridge magazine holders, are movable relative to one another in the transverse direction of the guide bridge, and in that the control system is equipped to move said cartridge magazines, or cartridge magazine holders, relative to one another and in that, preferably, at least one cartridge gripper is 25 provided per cartridge magazine, or cartridge magazine holder.

17. Solid phase extraction instrument according to one of Claims 11 - 16, characterised in that the input means are equipped for entering an operator's choice for a specific solid phase extraction process and in that the control system is equipped to select the type of cartridge belonging to that specific solid phase extraction process; and/or in 30 that the input means are equipped to enter an operator's choice for a specific type of cartridge, the control system being equipped to determine the specific cartridge location which contains an unused cartridge of that selected or specified type of cartridge.

18. Solid phase extraction instrument, preferably according to one of Claims 11 - 17,

REPLACED BY
ART 34 A33/07

wherein the at least one line system comprises at least one single or multi-way valve which is functionally connected to the control system for operation and comprises at least two cartridge holders, characterised in that the control system is equipped to:

- a) switch two cartridge holders in series; and/or
- 5 b) to switch the one cartridge holder in liquid communication with a solvent feed device located upstream thereof and to be able to switch the other cartridge holder in simultaneous liquid communication with a sample feed device located upstream thereof; and/or
- c) to switch the one and the other cartridge holder each in mutual simultaneous liquid communication with a solvent feed device or a sample feed device.

10 19. Solid phase extraction instrument according to one of Claims 11 - 18, characterised in that the at least one cartridge magazine and/or the cartridges are provided with code means for the type of cartridge in each cartridge location or for the type of cartridge, and in that the solid phase extraction instrument is provided with reading means 15 for reading the code means and for transmitting the code(s) read to the control system.

20. Solid phase extraction instrument according to Claim 19, characterised in that the control system is equipped to control the reading means to read the code means in order to store the type of cartridge associated with each cartridge location in a cartridge memory.

21. Solid phase extraction instrument according to Claim 20, characterised in that the control system is equipped to assign a used or unused status to each cartridge location in the cartridge memory.

22. Solid phase extraction instrument, preferably according to one of the preceding claims, comprising

- at least one line system for transporting a liquid;
- 25 - a cartridge exchanging system having at least one cartridge holder incorporated in the line system;
- a sample feed device connected to the line system;
- a solvent feed device connected to the line system; and
- a control system,

30 characterised in that

the solvent feed device comprises an "injection pump"; and

in that the control system is equipped to control the suction stroke speed and/or the suction stroke length of the injection pump so as to draw in solvent at a specific speed or in a

REPLACED BY
ART 34 AMDT

specific quantity.

23. Solid phase extraction instrument according to Claim 22, characterised in that the injection pump has been designed with a capacity such that it is able to take up the total quantity of solvent required for a solid phase extraction step in order to be able to force 5 this through the line system with an uninterrupted delivery stroke.

24. Solid phase extraction instrument according to Claim 23, characterised in that the control system is equipped first to control the injection pump to take up the total quantity of solvent required for a solid phase extraction step and then to control the injection pump to force this total required quantity through the line system with an uninterrupted delivery 10 stroke.

25. Solid phase extraction instrument according to one of Claims 22 - 24, characterised in that the control system is equipped to be able to control the injection pump for a delivery stroke with an essentially constant speed or delivery pressure.

26. Solid phase extraction instrument according to one of Claims 22 - 25, 15 characterised in that a pressure sensor for measuring the pressure in the injection pump is provided in or by the injection pump, which pressure sensor is actively connected to the control system in order to transmit a pressure signal to the latter.

27. Solid phase extraction instrument according to one of Claims 22 - 26, characterised in that the solvent feed device comprises a first multi-way valve to which, on 20 the one side, the injection pump is connected by means of the suction channel and which, on the other side, is provided with a number of solvent connections to which solvent reservoirs can be connected or have been connected, and in that the control system is equipped to switch the multi-way valve during suction by the injection pump in such a way that a mixture is drawn in which is further mixed in the 25 syringe and/or to switch the multi-way valve prior to suction by the injection pump .

28. Solid phase extraction instrument according to Claim 27, characterised in that the suction channel of the injection pump connected to one side of the multi-way valve is also a pressure channel and in that the multi-way valve is further connected on the other side to the line system.

29. Solid phase extraction instrument according to Claim 27 or 28, characterised in 30 that the solvent feed device comprises at least a further multi-way valve to which, on the one side, one of the solvent connections of the first multi-way valve is connected and which, on the other side, is provided with further solvent connections.

RECEIVED
APR 22 2000
USPTO

30. Solid phase extraction instrument according to one of Claims 22 - 29, characterised in that the control system comprises input means for entering an operator's choice for

- a specific solid phase extraction process; and/or
- 5 - a specific solvent or combination of solvents; and/or
- a specific delivery pressure; and/or
- a specific suction speed; and/or
- a specific solvent volume; and/or
- a specific ratio of solvent volumes.

10

REPLACEMENT
ART 34 AMENDMENT